CHANGING WHAT'S POSSIBLE

# PERFORMANCE-BASED ENERGY RESOURCE FEEDBACK, OPTIMIZATION, AND RISK MANAGEMENT:

# PERFORM

ARPA-E PERFORM FOA:
https://arpa-e-foa.energy.gov/#Foaldcf23a62d-a269-4369-a408-bfb4ba014f8d

Program Director Dr. Kory W. Hedman

EPIC Forum, February 25, 2020

# ARPA-E Mission

Overcome long-term and high-risk technological barriers in the development of energy technologies

# PERFORM Funding Opportunity Announcement

https://arpa-e-foa.energy.gov/#Foaldcf23a62d-a269-4369-a408-bfb4ba014f8d

## DE-FOA-0002171: PERFORMANCE-BASED ENERGY RESOURCE FEEDBACK, OPTIMIZATION, AND RISK MANAGEMENT (PERFORM)

Optimal utilization of all grid assets requires a fundamental shift in grid management rooted in an understanding of asset risk and system risk. ARPA-E seeks innovative management systems that (i) represent the relative delivery risk of each asset and (ii) balance the collective risk of all assets across the grid. A risk-driven paradigm will allow operators to fully understand the true likelihood of maintaining a supply-demand balance and system reliability; this is critical for all power systems and is essential for grids with high levels of stochastic resources.

Existing management practices were designed for a grid consisting of and fully reliant on conventional generation assets. Present operational and planning practices do not acknowledge or leverage the true capabilities and associated challenges of emerging assets. A risk-driven paradigm will allow emerging assets to be trusted and relied upon to provide the critical products and services necessary to maintain an efficient and reliable grid, thereby breaking the persistent reliance on conventional generation technologies.

Through the **Performance-based Energy Resource Feedback, Optimization, and Risk Management** (PERFORM) program, Applicants will propose methods to quantify and manage risk at the asset level and at the system level. At the asset level, ARPA-E envisions the design of a risk score or measure that clearly communicates the physical delivery risk of an asset's offer, similar to the role a credit score plays in determining the creditworthiness of an individual. At the system level, ARPA-E envisions the design of grid management systems that endogenously capture uncertainty and evaluate and hedge the system risk position to meet or exceed a baseline system risk index. The anticipated outcome of PERFORM is a transformative and disruptive risk-driven grid management paradigm that optimally utilizes all assets (including emerging technologies) to reduce costs and improve reliability.

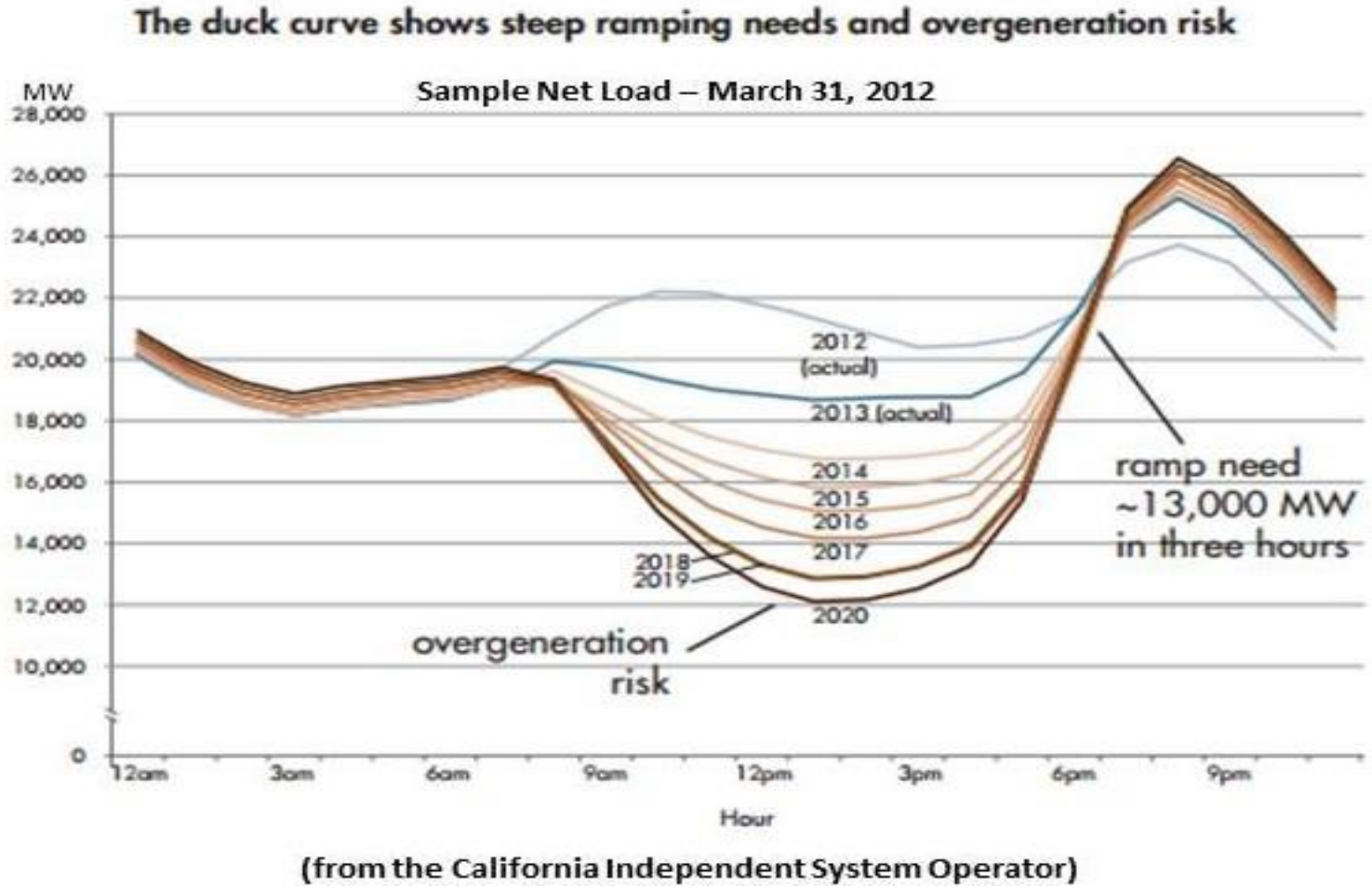
ARPA-E expects PERFORM awardees to build on existing practices and expertise from the finance, insurance, and actuarial science communities, which have a long history of defining, quantifying, and hedging risk. Applicants should pursue partnerships with these communities along with domain-specific experts (e.g., engineers, operations researchers, and market designers) to achieve technically relevant innovative solutions. PERFORM is targeting all power sectors: (i) bulk and distribution systems, (ii) centralized and decentralized paradigms, and (iii) vertically integrated utilities, markets, and peer-to-peer transactive energy systems.

### DOCUMENTS

- PERFORM FOA Mod 03 (Last Updated: 1/8/2020 12:36 PM ET)

# Risk Paradigm: Variability

CAISO Website

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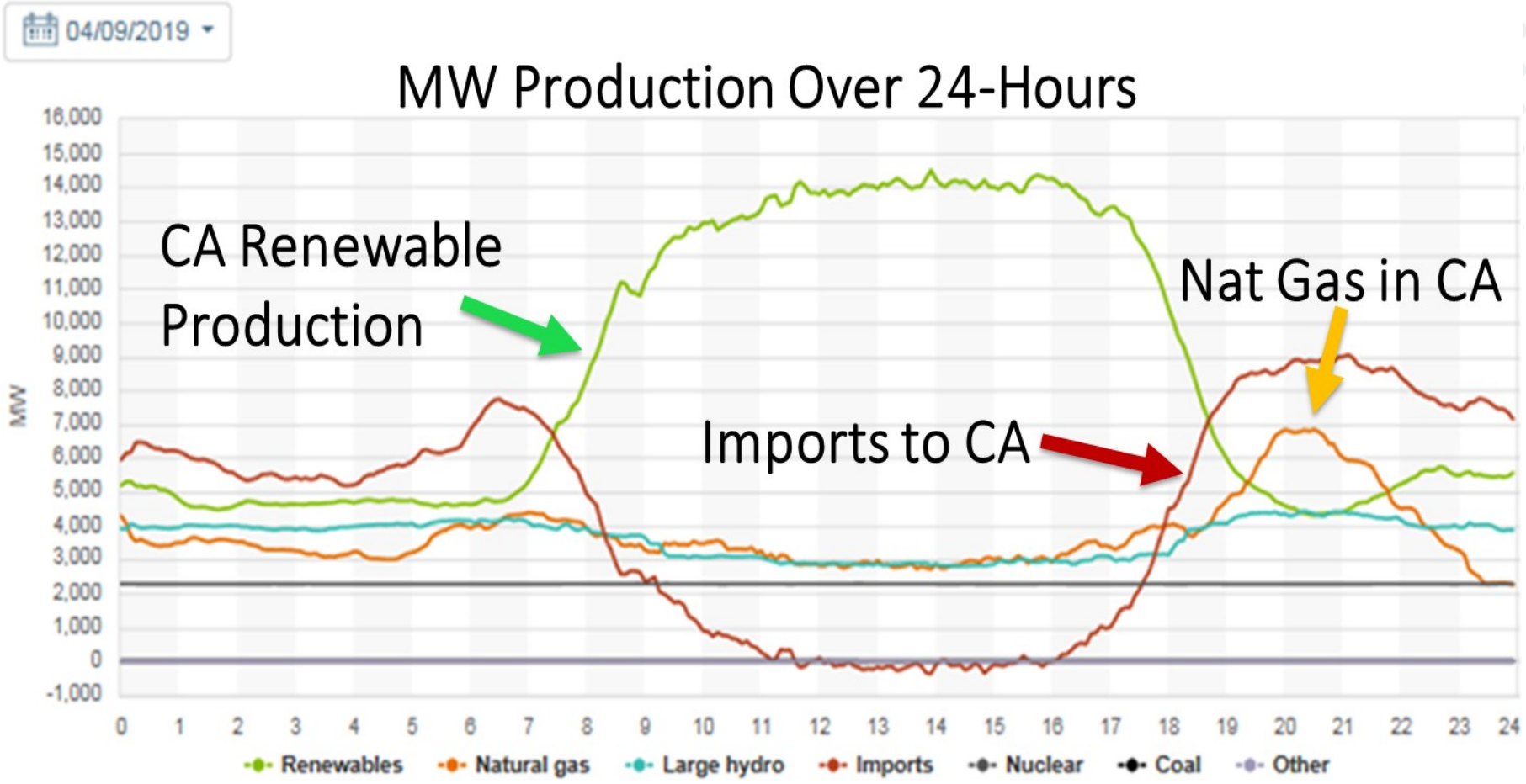
# Managing Variability

CAISO Website
April 9, 2019

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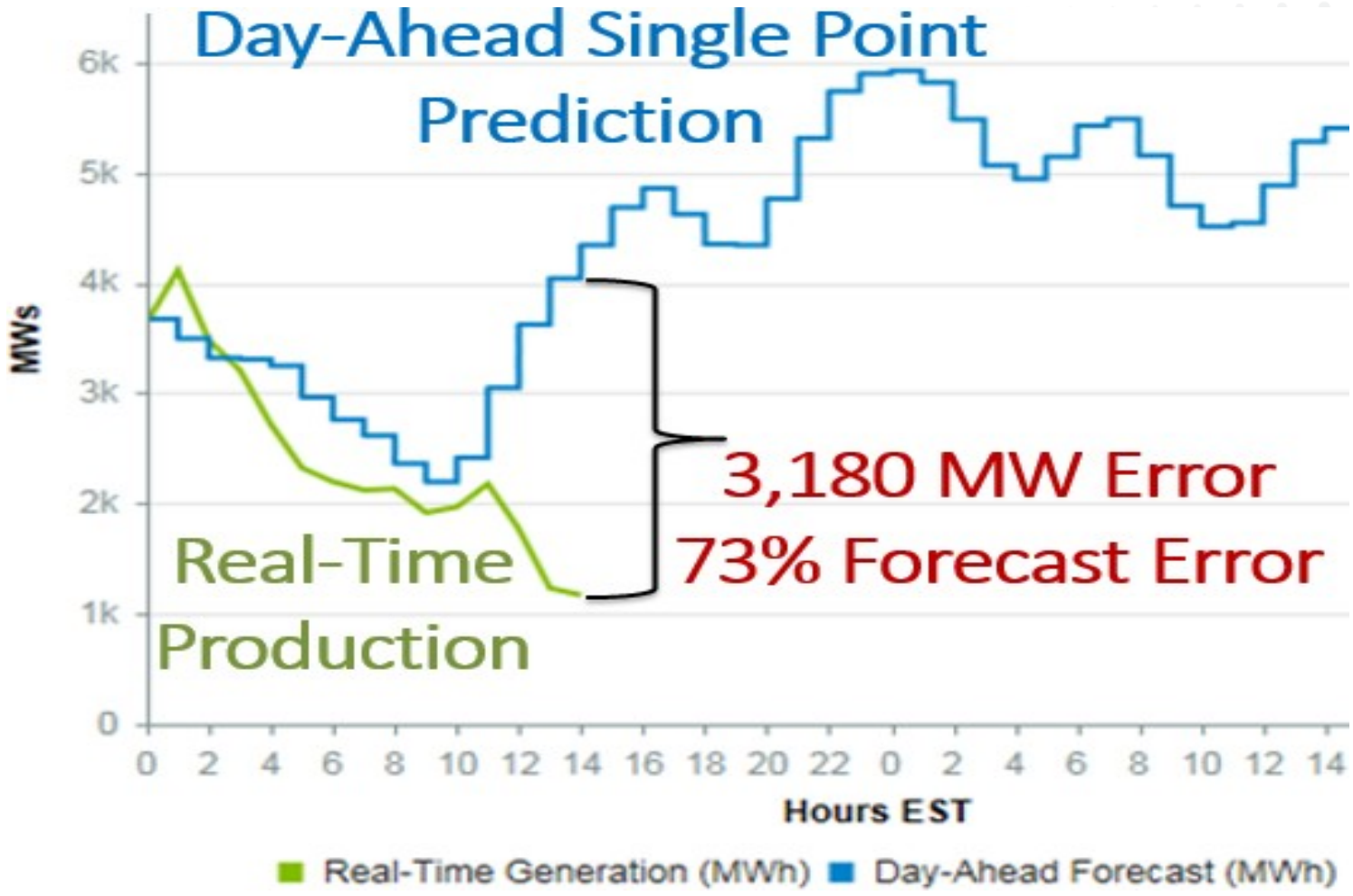
# Risk Paradigm: Uncertainty

MISO Website
June 26, 2019

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# Risk Paradigm: Extreme Events

MISO Website

*PERFORM FOA: It is critically important to acknowledge, quantify, and evaluate asset variability and uncertainty along with **correlation** across assets, especially for systems dominated by stochastic resources.*

Midcontinent Independent System Operator (MISO) events:

- **July 29, 2018: 1MW** renewable power produced for one operational state
- **July 28, 2018: 128MW** renewable power produced over an hour
- 2018 MISO Renewable Capacity: 18GW

Midcontinent Independent System Operator, "MISO 2018 Summer Assessment Report," pp. 4, September 2018. Online. Available: https://cdn.misoenergy.org/2018%20Summer%20Assessment%20Report283263.pdf

*PERFORM FOA: It is essential to also consider **negative correlation** across stochastic resources such that **extreme events** (e.g., when very little renewable production is present) can be minimized.*

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# PERFORM Program Objective

Risk-based operational paradigm capturing *marginal cost and marginal risk*:

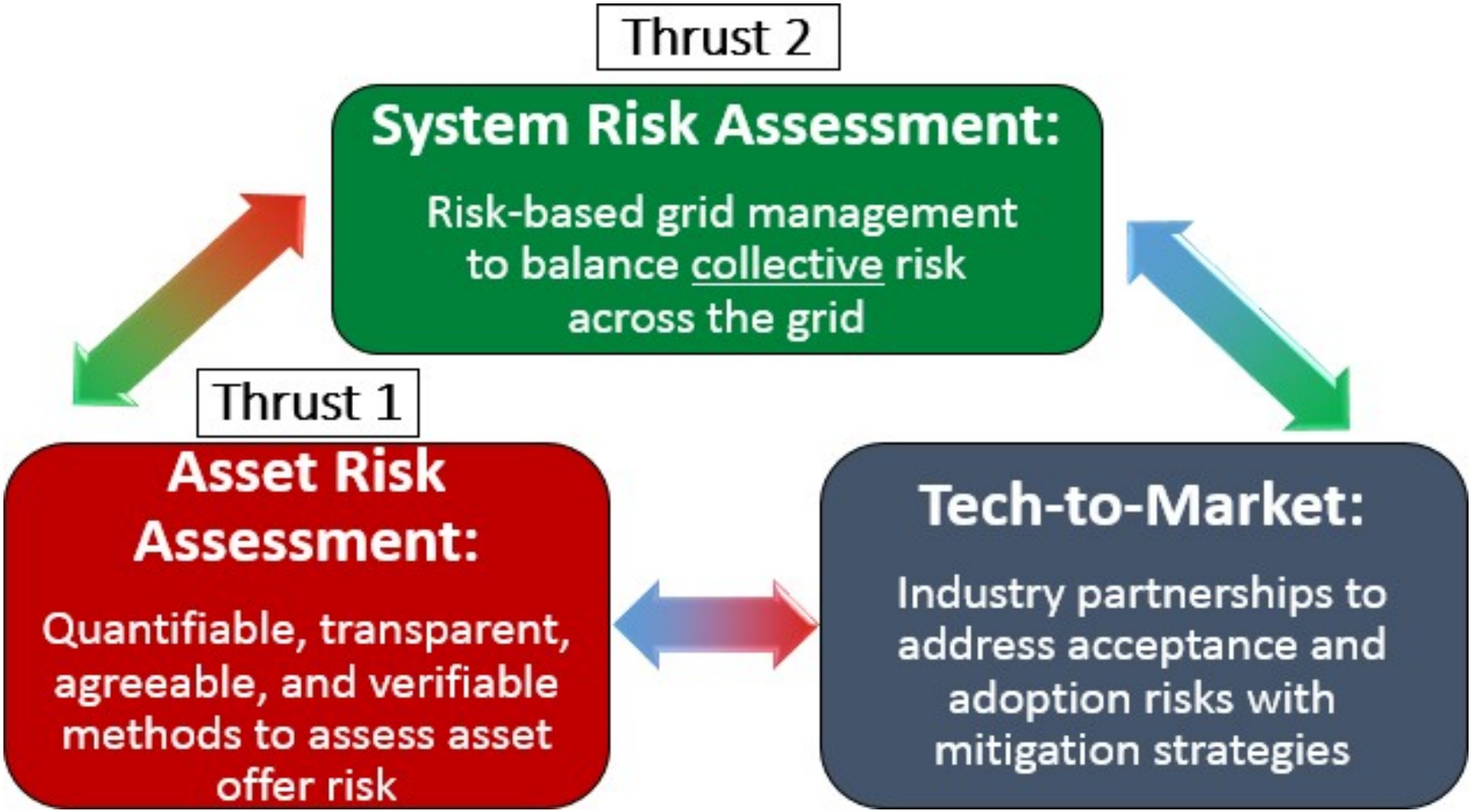
- Utilize the full potential of emerging technologies (e.g. bulk renewables, DERs, storage)
- Enable increased renewable penetration
- Lower energy costs

*…without sacrificing service quality or reliability*

A modern grid with modern assets requires modern operational and management systems

ARPA-E PERFORM Workshop, PERFORM_Mod.pptx file, Slide 4.
https://arpa-e.energy.gov/?q=workshop/performance-based-energy-resource-feedback-optimization-and-risk-management

# PERFORM Program Structure

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Questions about PERFORM FOA? Check the FAQs available at http://arpa-e.energy.gov/faq.
For questions that have not already been answered, email ARPA-E-CO@hq.doe.gov.